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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/785,291	02/20/2001	Tae Jung Kim	EM/KIM/6544	4230

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EXAMINER

KIBLER, VIRGINIA M

ART UNIT	PAPER NUMBER
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2623

DATE MAILED: 03/31/2004

3

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/785,291

Applicant(s)

KIM ET AL.

Examiner

Virginia M Kibler

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-6 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1 and 3-6 is/are rejected.
- 7) ☒ Claim(s) 1-6 is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 20 February 2001 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
- 1) ☒ Certified copies of the priority documents have been received.
 - 2) ☐ Certified copies of the priority documents have been received in Application No. ____.
 - 3) ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|-----------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. ____. |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date ____. | 6) <input type="checkbox"/> Other: ____. |

DETAILED ACTION

Drawings

1. The drawings are objected to because “Assum” should be changed to “Assume”; “coordiate” should be changed to “coordinate”; and “colliniear” should be changed to “collinear” in Figure 2, S100. A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Specification

2. The disclosure is objected to because of the following informalities: it appears that the Expression 8 on page 11 is missing a “+” in the first term of the denominator, “ $(A_4x_1 + A_5y_1 + A_6)\sin Q(x_r)$ ” before A_6 .

Appropriate correction is required.

Claim Objections

3. Claims 1-6 are objected to because of the following informalities: “Expressions” should be changed to “expressions” in claim 1, lines 11 and 18 and in claim 2, line 3.

Claim 1 is also objected to for the limitations recited inside parenthesis. All limitations shall be explicitly recited.

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In claim 2, it appears that the equation is missing a "+" in the first term of the denominator, " $(A_4x_1 + A_5y_1 A_6)\sin Q(x_r)$ " before A_6 .

Claims 2-6 are dependent on claim 1, and are thereby objected to.

Appropriate correction is required.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 1 and 3-6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rademacher et al. ("Multiple-Center-of-Projection Images") in view of Gupta et al. ("Linear Pushbroom Cameras").

Regarding claim 1, Rademacher et al. ("Rademacher") discloses extracting an epipolar curve $C'q$ of the right image corresponding to one point q on the left image (Sect. 6) including calculating the coordinate value of a straight line for connecting a focal point of the left image and the one point q on the left image (Figure 10c), substituting the calculated coordinate value of the straight line of the one point q' of the right image, and deriving an equation of the epipolar curve $C'q$ of the right image for the one point q of the left image (Figure 10d; Sect. 6).

Rademacher does not appear to expressly indicate assuming that the coordinates for the positions of the left and right cameras and the coordinates of the rotation angles of the left and right

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cameras are linear or nonlinear polynomials of a time or an image coordinate, and then deriving collinear equations consisting of various expressions. However, Gupta et al. ("Gupta") teaches that it is known derive collinear equations consisting of various expressions (Sect. 5.1).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have modified the extraction of an epipolar curve disclosed by Rademacher to include deriving collinear equations as taught by Gupta because it encodes the relative orientation of two linear pushbroom cameras (Sect. 5, para. 3).

Regarding claim 3, Rademacher discloses the epipolar curve of the LPB sensor has the form of a curved line but not a straight line (Sect. 6).

Regarding claim 4, Rademacher discloses the epipolar curve of the linear pushbroom sensor having the form of a curved line (Sect. 6), but does not appear to recognize assuming it to be a straight line in a small region. However, it would have been obvious to one of ordinary skill in the art at the time of the invention to have modified the curved line disclosed by Rademacher to include linear approximation for a small region because it is a methodology routinely implemented in the art to approximate curve line calculations.

Regarding claim 5, Rademacher discloses assuming that the epipolar curve $C'q$ of the right image is obtained from the one point q of the left image of the stereoscopic image photographed by the LPB sensor and the epipolar curve Cq' of the left image is obtained from the one point q' of the right image corresponding to the one point q of the left image, in the case of the stereoscopic image photographed by the LPB all the points on the epipolar curve $C'q$ are not mapped onto the epipolar curve Cq' and all the points on the epipolar curve Cq' are not mapped onto the epipolar curve $C'q$ (Figure 10).

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Regarding claim 6, Rademacher discloses wherein the case where $C'q$ and Cq' have been obtained, it is assumed that points on the epipolar curve $C'q$ are mapped onto the epipolar curve Cq' and points on the epipolar curve Cq' are mapped onto the epipolar curve $C'q$ only for both a small region near the one point q of the left image and a small region near the one point q' of the right image (Figure 10).

Allowable Subject Matter

6. Claim 2 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Other Prior Arts Cited

7. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

U.S. Pat. No. 5,550,376 to Gupta et al. for calibration of imaging devices;

U.S. Pat. No. 5,559,334 to Gupta et al. for epipolar reconstruction of 3D structures;

U.S. Pat. No. 6,633,665 to Kim et al. for 3-D object points onto 2-D image points for LPB images;

JP 61-286978 to Furumura et al. for processing system for stereo observing picture;

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Kim, "A Study on the Epipolarity of Linear Pushbroom Images," PE & RS August 2000,
Abstract; and

Lee et al., "Accurate DEMik Extraction from SPORT Stereo Pairs: A Stereo Matching
Algorithm Based on the Geometry of the Satellite," ACRS 1999, pages 1-6.

Contact Information

8. Any inquiry concerning this communication or earlier communications from the
examiner should be directed to Virginia M Kibler whose telephone number is (703) 306-4072.
The examiner can normally be reached on Mon-Thurs 8:00 - 5:30 and every other Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's
supervisor, Amelia Au can be reached on (703) 308-6604. The fax phone number for the
organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent
Application Information Retrieval (PAIR) system. Status information for published applications
may be obtained from either Private PAIR or Public PAIR. Status information for unpublished
applications is available through Private PAIR only. For more information about the PAIR
system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR
system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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3/14/04

**MEHRDAD DASTOURI
PRIMARY EXAMINER**

Mehrdad Dastouri